

NURail Environmental GIS Project Documentation

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1 Overview

1.1 System and Software Requirement for the Local Machine

There is only minimum requirement on the local machine. ArcMap is required for data view and processing (refer to Chapter 3.1 for details on the use of ArcMap). Java is strongly recommended in order to use the legacy programs. Javascript has to be enabled on the web browser of the local machine.

1.2 System and Software Requirement for the Web Server

Due to the budget limit, [Geoserver](#) [1], an open source software, is chosen as the GIS server for our web application. The Geoserver is hosted via the [UIC virtual server](#) [2]. Therefore, the person who is in charge of maintaining the website needs to **get an account from UIC ACCC in order to ssh-login the virtual server**. (However, UIC virtual server can be replaced if a better host exists.) The following information gives specifics of the setup environment.

- UIC Virtual Server Domain Name: <http://nurail.uic.edu/>
 - Path to the geoserver data folder (this is the place where all data of layers reside):
`/usr/share/tomcat6/webapps/geoserver/data/data/`
 - Path to the website contents (this is the place where the website htmls reside):
`/var/www/html/`
 - subpaths to the [cbtree javascript library](#) [3] (required by the project):
`/js/cbtree/`
 - subpaths to javascripts codes: `/js/sol/`
 - `leftPane.js`: this is the file which handles the left pane of the interactive map tool. It deals with the operations of the tree that organizes all the data layers
 - `loadMap.js`: this is the file which initializes the map component of the tool

(for more details, please read the comments in the source files)
 - subpaths to images used in the website: `/img/`
 - subpaths to css files: `/css/`
- Geoserver web GUI url: <http://nurail.uic.edu/geoserver/> **username: admin** ,
password: geoserver (you can change the password via the web GUI once logged in)

2 Getting Started For Administrators

2.1 Procedure to Add a New Data Layer

The following procedure is used when you already have data for a layer and you want to add the layer to the interactive map tool. When preparing the data for a layer, you may need to do some pre-processing (please refer to Chapter 3 for more details).

1. Create a new folder for the new data layer
 - i. Login the virtual server using ssh (if you are outside the UIC campus, you need to connect to UIC network via [VPN](#) [4])
 - ii. First create an empty folder under ~
 - iii. Move it from ~/ to geoserver folder (require sudo) (otherwise if create under geoserver folder, the folder creator will be root instead of your account name, as a result, you cannot upload files via login as your account)
2. Upload the data
 - i. Connect to the virtual server using sftp
 - ii. Change permission (chmod) of the uploaded files and its folder
3. Create the data layer via Geoserver web GUI
 - i. First add a store (choose a shapefile from the newly added folder)
 - ii. Publish the layer (choose projection EPSG:4269)
 - iii. Choose the Publish tab to change the style file by clicking the "default style" button. (for customizing layer styles, see Chapter 2.3 for more details)
4. Modify the leftPane.js file to reflect the update
 - i. Update the tree_hierarchy.txt and update the fields defined in the leftpane.js (for more detail, see Chapter 2.2)
 - ii. Modify the loadMap.js file to update fields “popupAttributesForLayer” and “meaningfulAttributeNames”. (this is required when you wants to show detail information clicking on a specific feature of the layer)
5. Document the change
 - i. Update the data_provenance file to record the data source of the layer

2.2 Maintaining the Layer Structure

The layer structure shown in the left pane of the GIS map tool is implemented using the CBTree library. That is to say, all the layers are organized as a tree. A lot of fields in the leftPane.js are associated with the tree hierarchy of the layers. It would be painful to manually update all such fields whenever there is an update on the tree hierarchy.

For this purpose, CreateTreeHierarchyData.java file is implemented to read the raw hierarchy file “tree_hierarchy.txt” and build the fields reference in the leftPane.js file automatically. Whenever there is an update to the tree hierarchy of the layers, you simply update the

“tree_hierarchy.txt” and run CreateTreeHierarchyData.java, and finally use the output from the java program to replace the old fields in the leftPane.js.

Following is the list of fields in the leftPane.js to be replace after each update.

- treeHierarchyData
- pathsOfAllLayers
- layerNamesInTheLeftPane
- WMSLayerNamesMapToTreeLayerNames
- layers

2.3 Layer Styling

Layer styling refers to the style of the rendering of the features in a data layer. Geoserve has a relative detail [document on customized style files](#) [5]. Manually write a style file can be tedious and time-consuming. For convenience, CreateCustomizedSLD.java file is created to automatically generate style files of certain types.

The current implementation can generate SLD files for many needs. For examples, these needs include but not limited to:

- Define the color/transparency for a polygon based on a field
- Define the color for a line based on a field
- Define the size for a point based on a field
- Define a random color palette

Please refer to the codes for more details. Many existing style files are generated using this tool and they are saved under /styles/ folder.

3 Data Processing for Certain Layers

Before adding a data layer to the server, certain pre-processing needs to be done to cook the raw data. This chapter explains some operations of this nature.

3.1 ArcMap Operations

- Create a new database from an existing one by selecting a value on a particular column:
 - i. Open attribute table, select, e.g. "LANDUSE3"='Residential'
 - ii. Output to shapefiles: System Toolboxes->To Shapefile (the output folder is a folder)
- Update the value of a field
 - i. Open the attribute table
 - ii. Select the field, right click Field Calculator

- iii. Choose the appropriate function
- Add new data with coordinates
 - i. File → Add data → Add X, Y data
 - ii. Note, X is longitude, Y is latitude. The first line of the data file is the header where two fields should be called “longitude” and “latitude”.
- Clip:
 - i. Geoprocessing → Clip
 - ii. Clip feature: e.g. the state boundary
- Export a shapefile from a layer
 - i. Right click the data source, choose Data-> Export data

3.2 Java Programs For Derailment Data

For derailment accident data, a java program (packaged in the riskanalys folder) is written in order to extract the derailment data from the raw data reports. Among other things, the program mainly counts the no. of accidents given the three variables defined in [6].

4 Reference:

- [1]. Geoserver Website <http://geoserver.org/display/GEOS/Welcome>
- [2]. UIC Virtual Server <http://accc.uic.edu/service/virtual-servers>
- [3]. Cbtrees javascript library http://thejeksels.com/dojo/cbtrees_AMD.html
- [4]. UIC Network VPN <http://accc.uic.edu/service/vpn>
- [5]. Geoserver Documentation on Styling <http://docs.geoserver.org/stable/en/user/styling/index.html>
- [6]. Xiang Liu, M. Rapik Saat, Christopher P. L. Barkan. “Analysis of Freight-Train Derailment Rates in the United States”. (Draft on July 23, 2013)